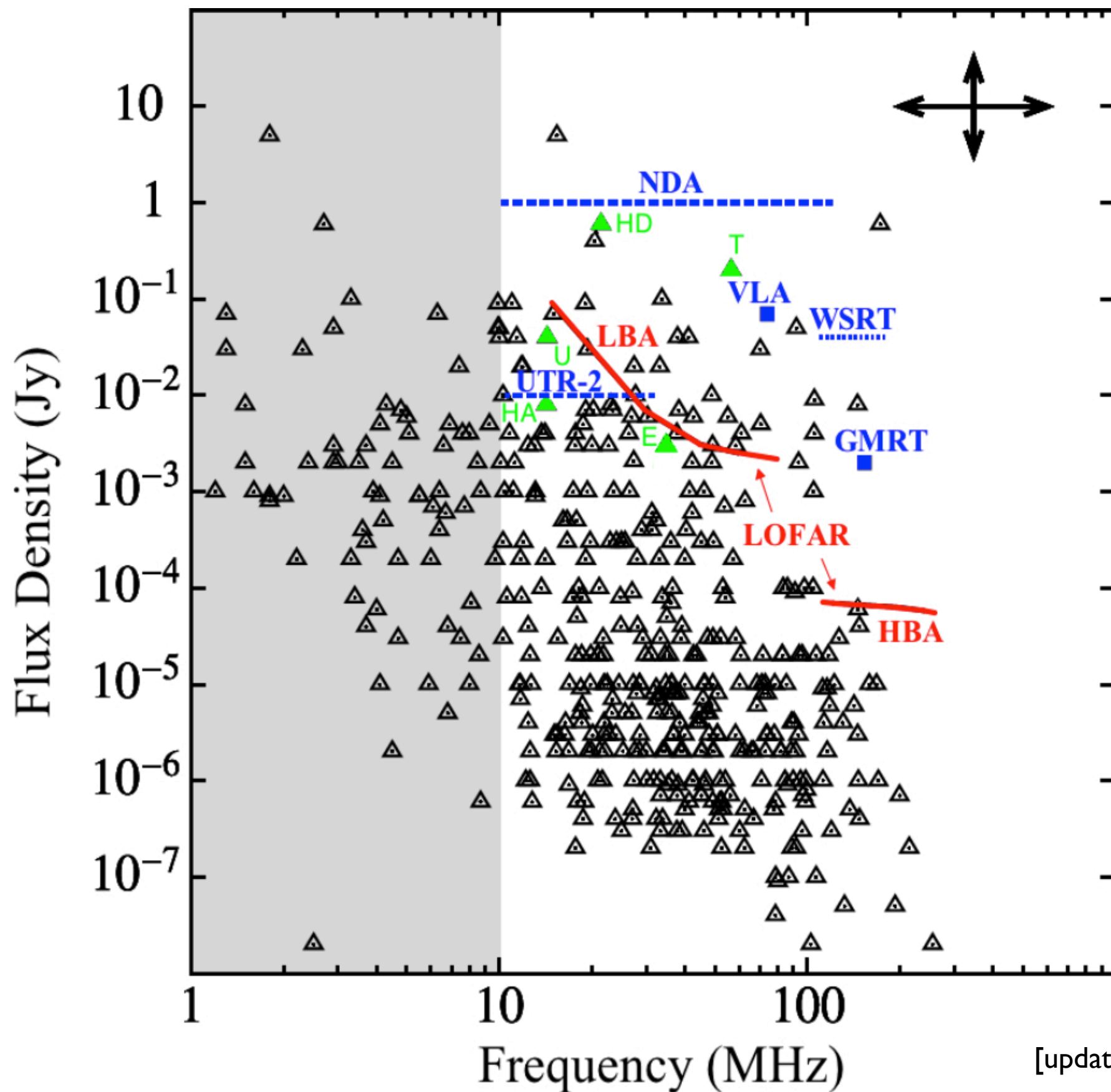


# Exoplanet radio search (and characterization)

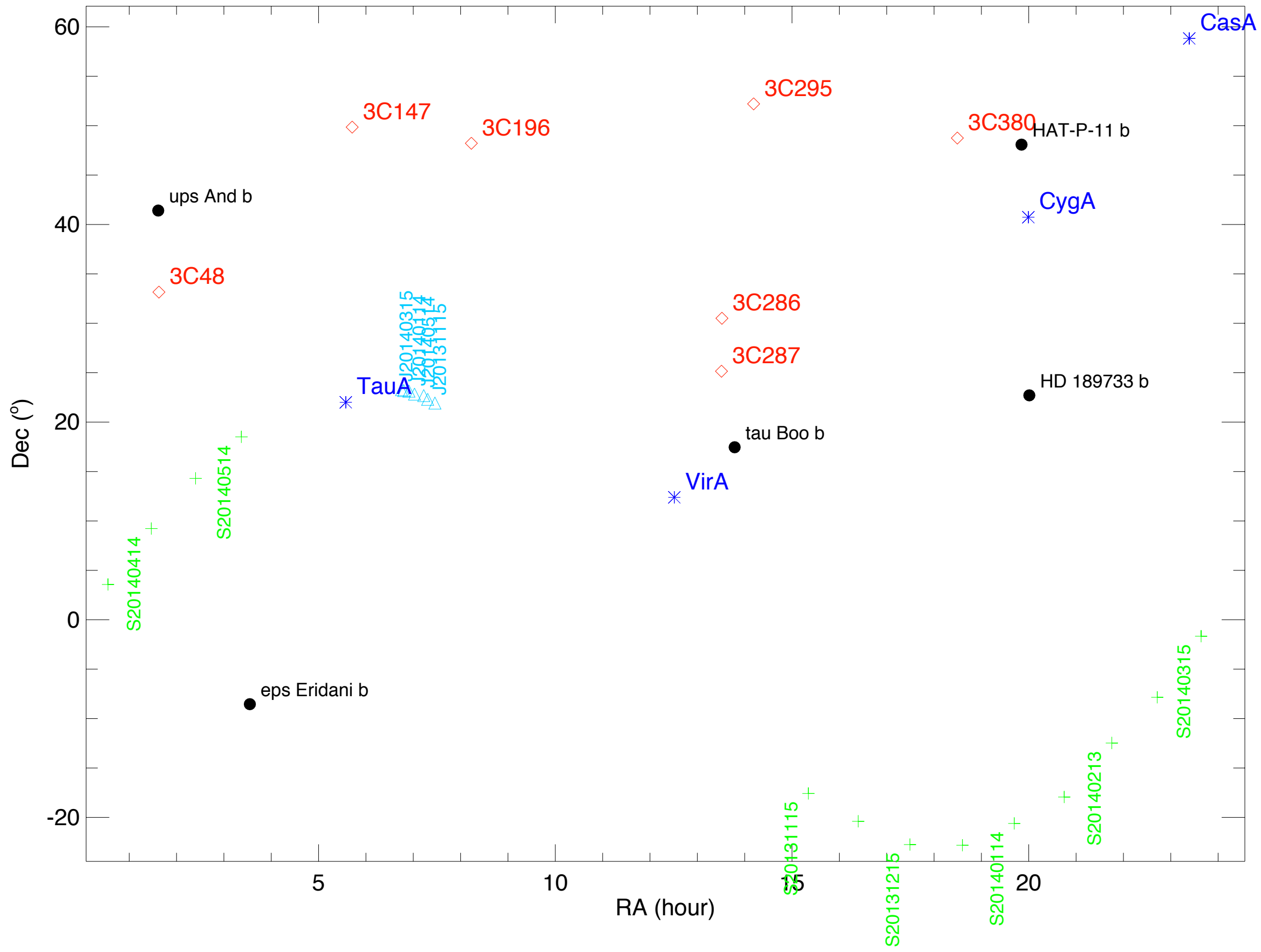
P. Zarka & the TKP-PEWVG

# Targets



Tau Boo  
Ups And  
HD 189733  
Hat-P-I I  
Eps Eri

# Targets



# Observations summary

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#1	TAU BOO	2013-02-26 01:25 - 04:25	(3 hours, night)	3C295 (35°)	(23 CS+13 RS)	CygA, VirA
#2	UPS AND	2013-02-27 13:40 - 15:40	(2 hours, day)	3C48 (8°)	(23 CS+13 RS)	CasA, CygA
#3	TAU BOO	2013-05-04 21:01 - 01:00	(3 hours, ~night)	3C295 (35°)	(24 CS+13 RS)	CygA, VirA
#4	HD189733	2013-05-09 03:00 - 06:00	(3 hours, night)	3C295 (70°)	(24 CS+13 RS)	CasA, CygA
#5	HAT P11	2013-06-10 00:00 - 04:00	(4 hours, night)	3C295 (51°)	(24 CS+13 RS)	CasA, CygA
#6	HD189733	2013-06-22 00:01 - 03:01	(3 hours, night)	3C295 (70°)	(24 CS+13 RS)	CasA, CygA
#7	HAT P11	2013-06-26 23:05 - 03:05	(4 hours, night)	3C295 (51°)	(24 CS+13 RS)	CasA, CygA
#8	UPS AND	2013-09-01 00:25 - 03:25	(3 hours, night)	3C48 (8°)	(23 CS)	CasA, CygA
#9	UPS AND	2013-10-25 21:47 - 23:47	(2 hours, ~night)	3C48 (8°)	(23 CS+10 RS?)	CasA, CygA
#10	EPS ERI	2013-11-07 22:22 - 01:22	(3 hours, night)	3C48 (49°)	(24 CS+13 RS)	CasA, CygA

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LBA-outer, 26-62 MHz (4 x 6 MHz) x 2 beams, 16-bit, 1 s, 64ch/sb, 4 Stokes  
Flagging, Demixing, Averaging 1 s x 4 ch/sb, Calibration

Obs #1,2 + UTR-2 (Konovalenko et al.)

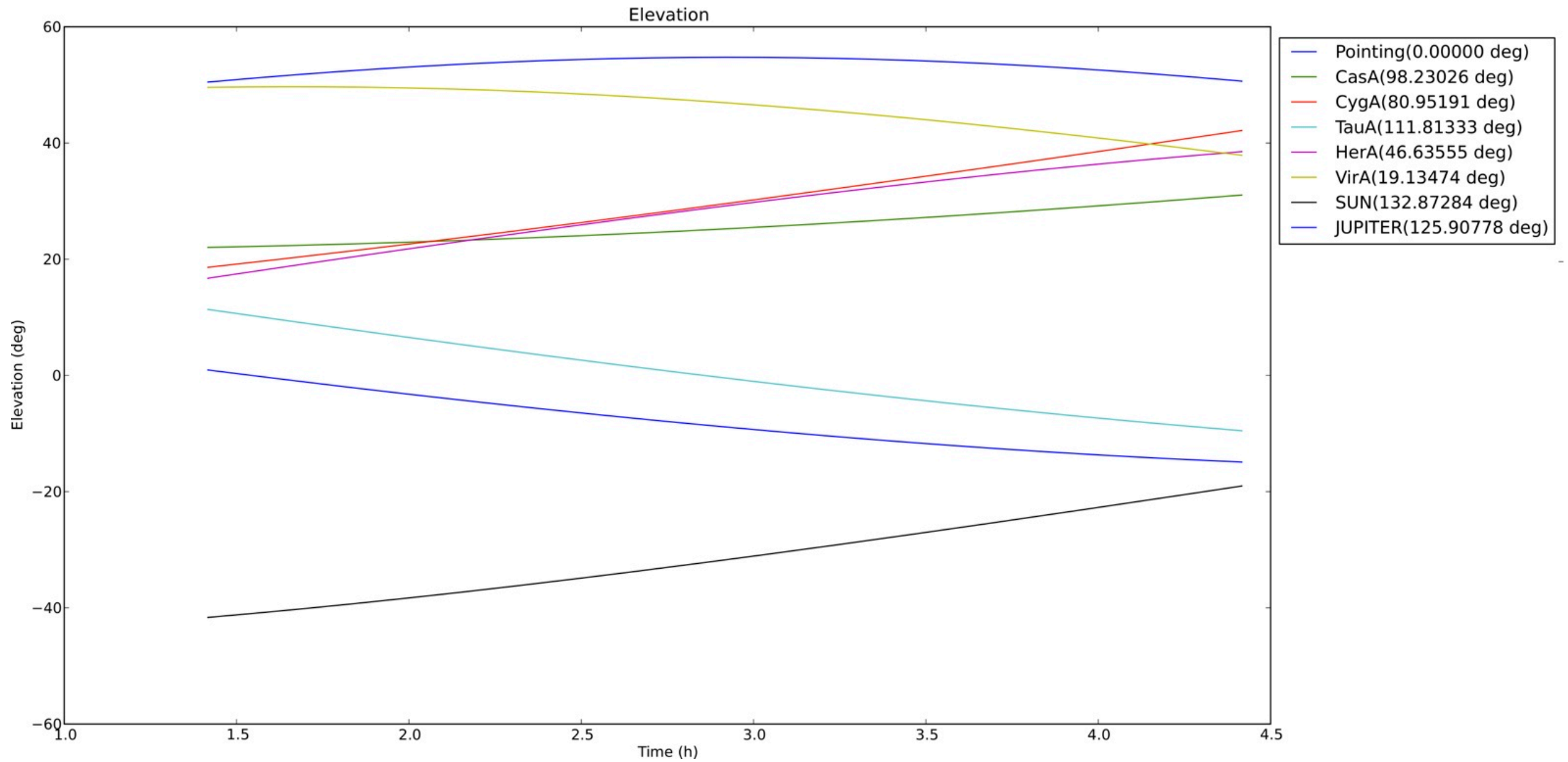
Obs #4 + XMM / NARVAL (Bourrier et al.)

Obs #6 8-bit (26-74 MHz)

Obs #8,9 IM + BF

# Demixing

#1 TAU BOO 2013-02-26 01:25 - 04:25 (3 hours, night) 3C295 (35°) (23 CS+13 RS) CygA, VirA





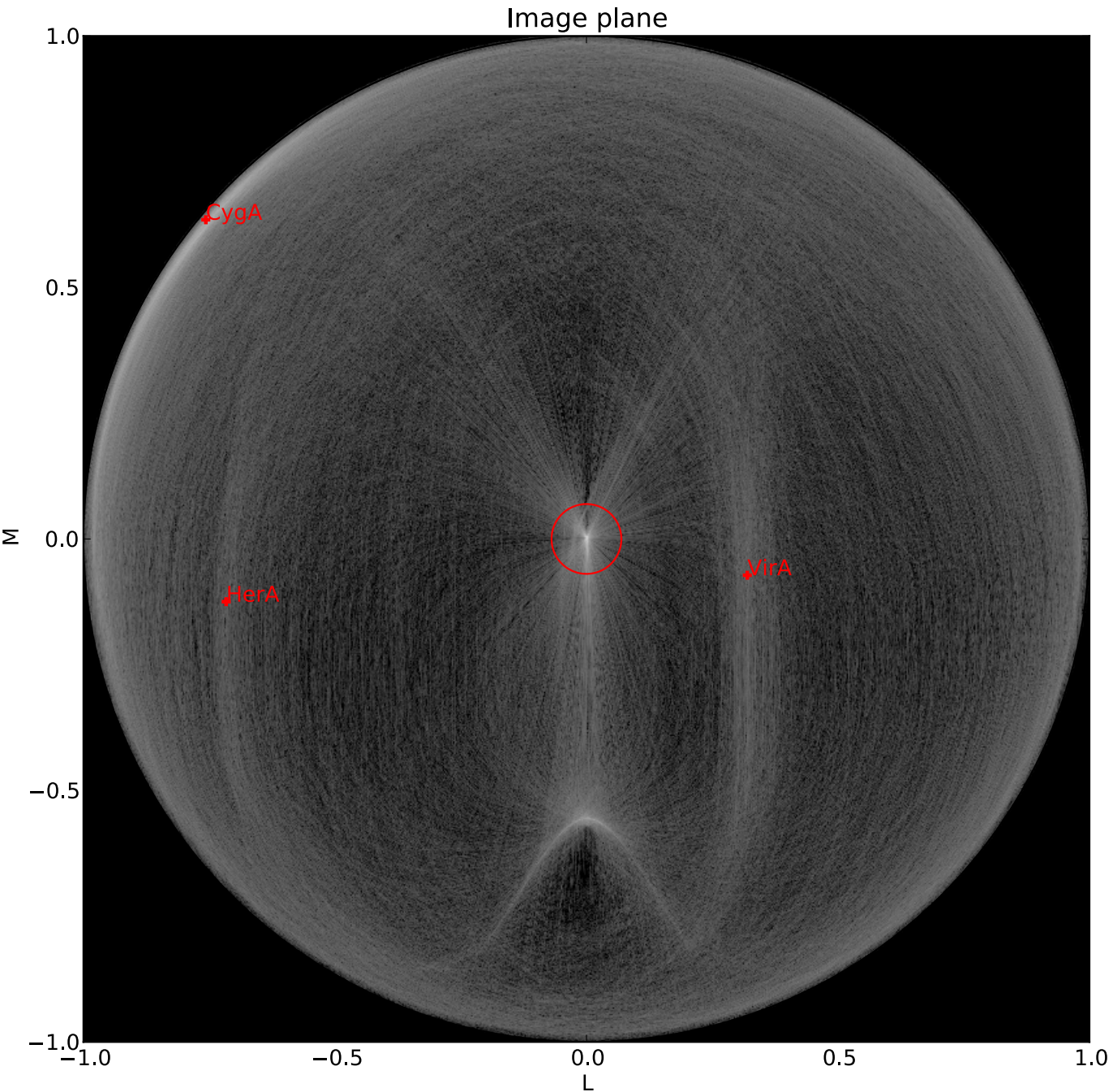
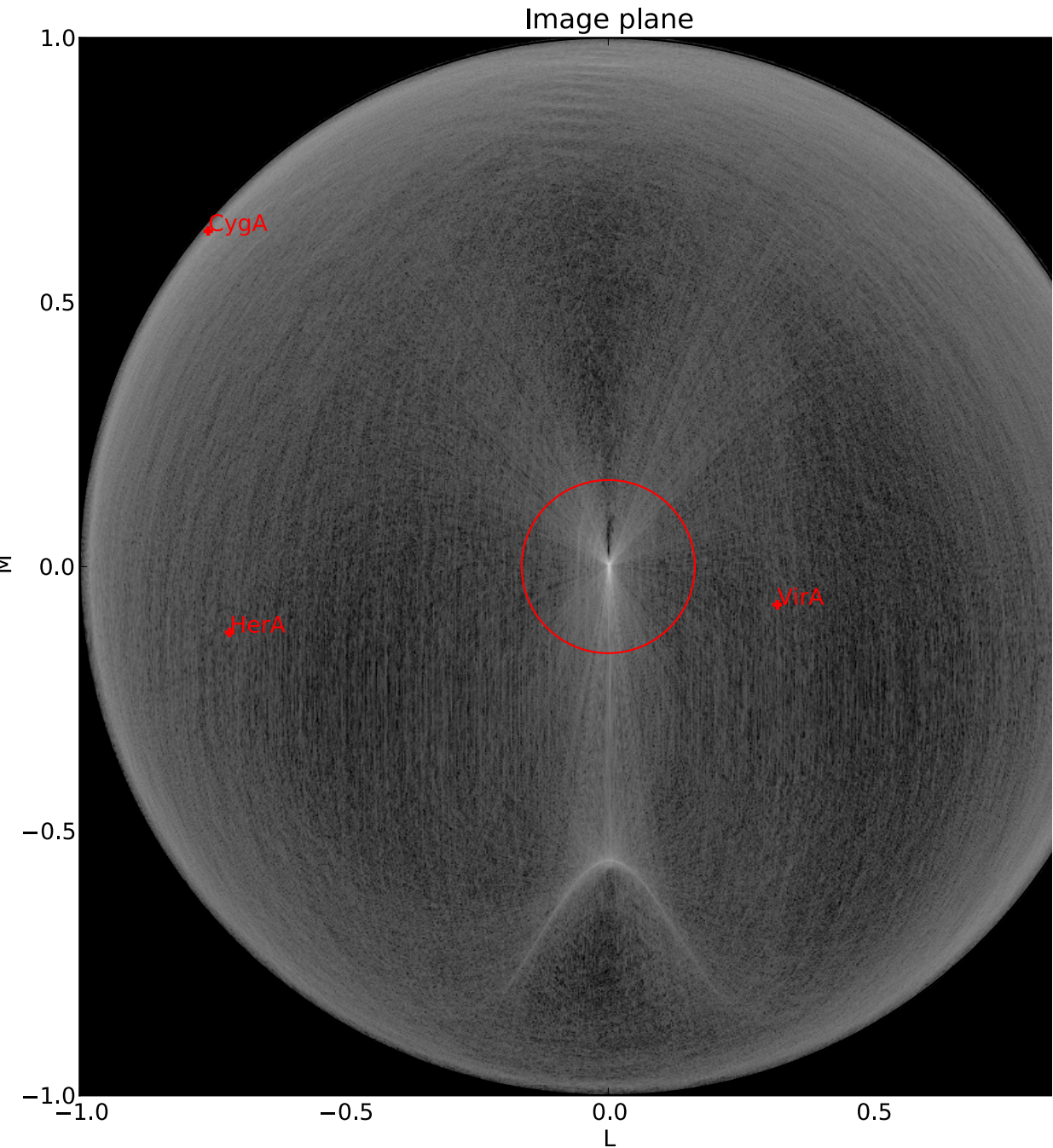
# Demixing

#1    TAU BOO    2013-02-26 01:25 - 04:25 (3 hours, night)    3C295 (35°)    (23 CS+13 RS)    CygA, VirA

SB000.pdf

(Target)

SB119.pdf



# Imaging

---

#2   UPS AND   2013-02-27 13:40 - 15:40 (2 hours, day)   3C48 (8°)   (23 CS+13 RS)   CasA,CygA

---

$f = 56$  MHz

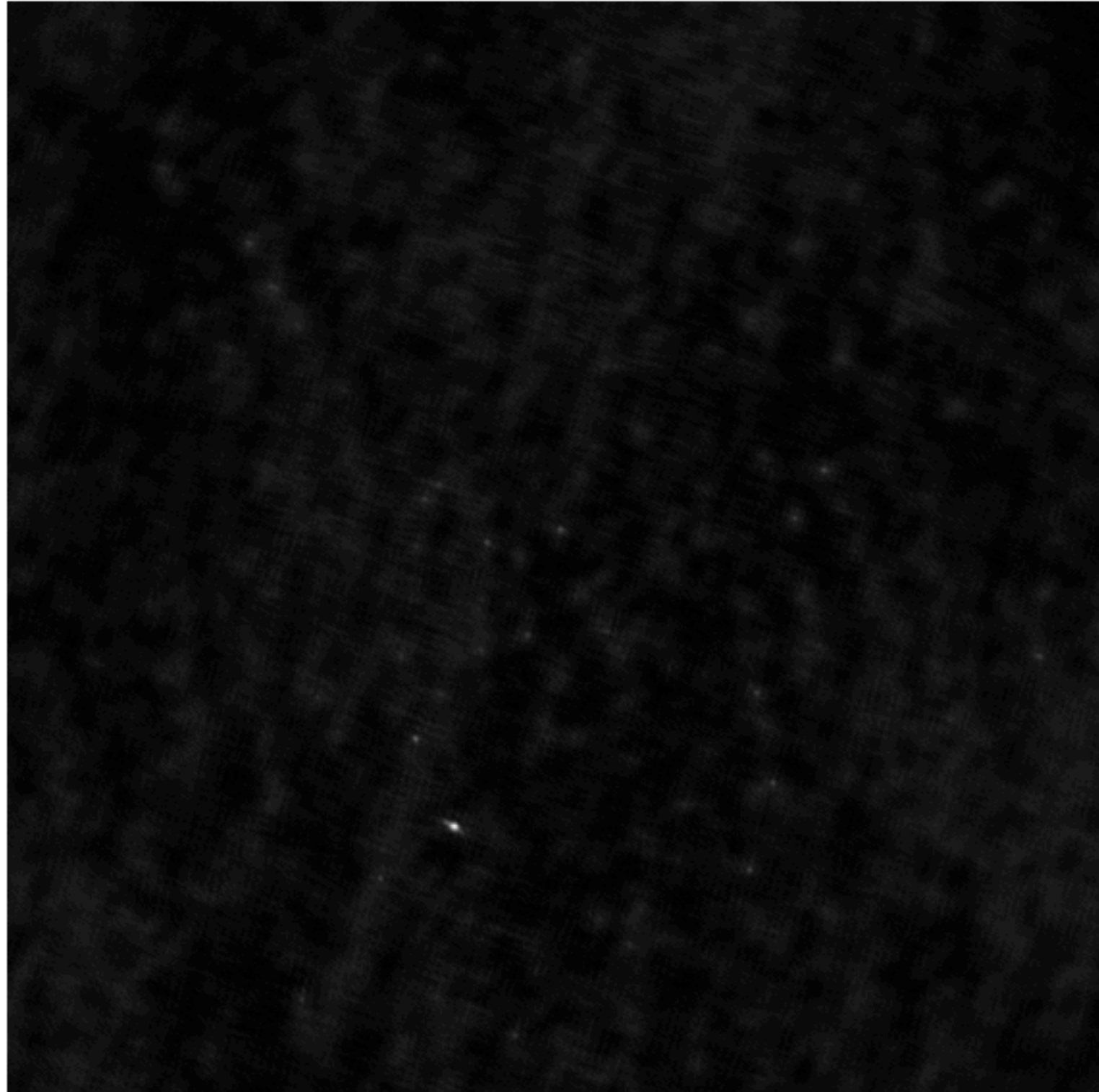
$df = 1$  SB (195 kHz)

pixel = 5 arcsec

image = 4096x4096 pixels  
= 6° x 6°

$(u,v) \leq 5000$  wavelengths

CSclean (CASA)



0.23

0.81

1.4

2

2.5

3.1

3.7

4.3

4.8

Jy/beam



# Imaging

---

#2   UPS AND   2013-02-27 13:40 - 15:40 (2 hours, day)   3C48 (8°)   (23 CS+13 RS)   CasA,CygA

---

$f = 56 \text{ MHz}$

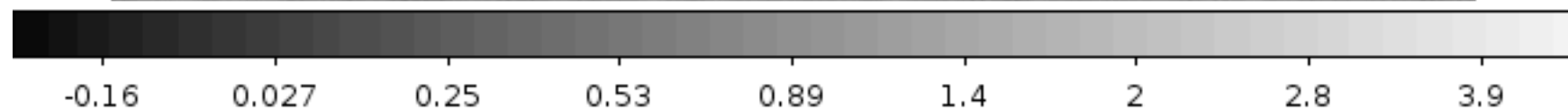
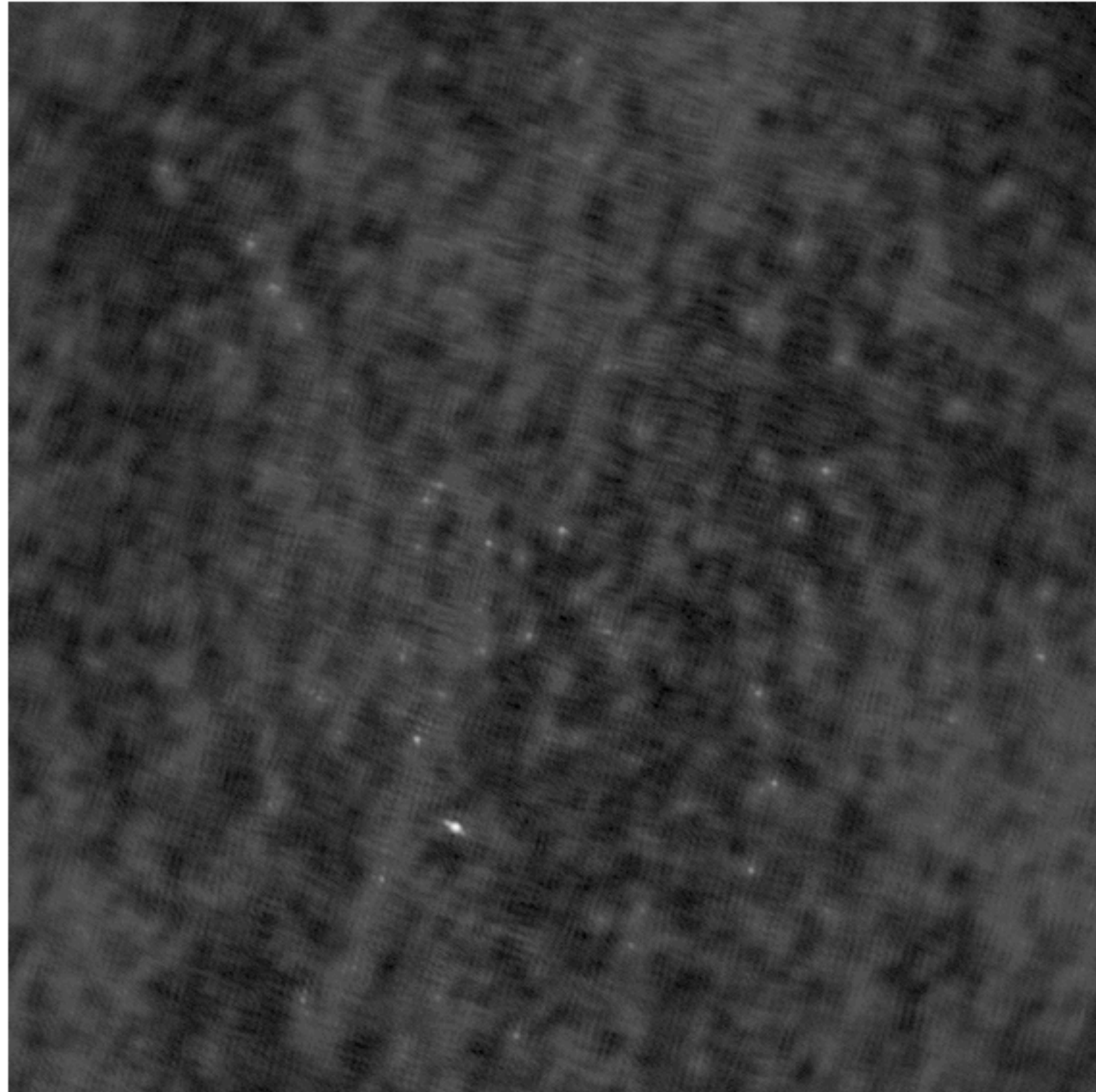
$df = 1 \text{ SB (195 kHz)}$

pixel = 5 arcsec

image = 4096x4096 pixels  
=  $6^\circ \times 6^\circ$

$(u,v) \leq 5000 \text{ wavelengths}$

CSclean (CASA)



Jy/beam



# Imaging

#2 UPS AND 2013-02-27 13:

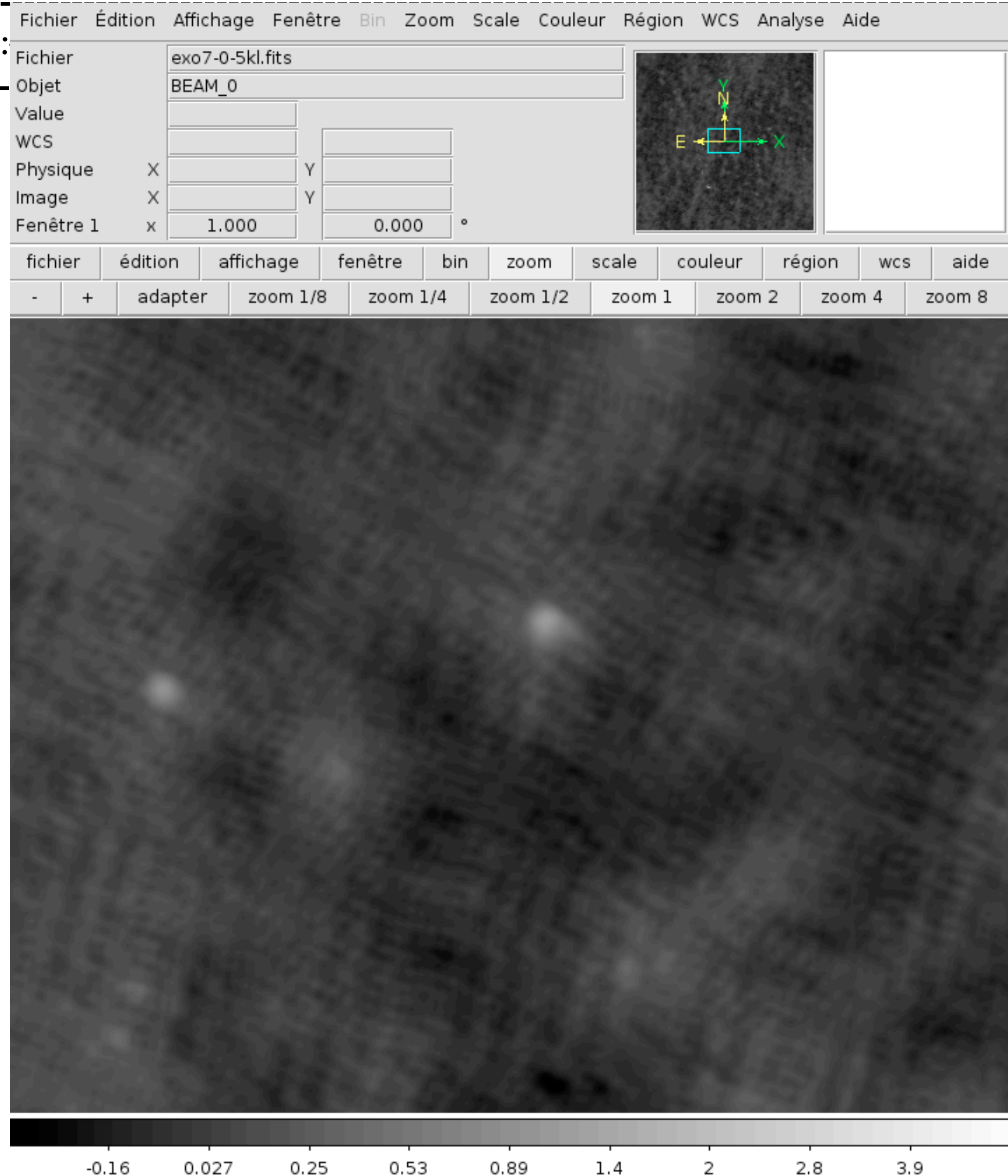
$f = 56 \text{ MHz}$

$df = 1 \text{ SB (195 kHz)}$

pixel = 5 arcsec

image = 4096x4096 pixels  
=  $6^\circ \times 6^\circ$

$(u,v) \leq 5000 \text{ wavelengths}$   
CSclean (CASA)



sA, CygA

Jy/beam

# Imaging

---

#2   UPS AND   2013-02-27 13:40 - 15:40 (2 hours, day)   3C48 (8°)   (23 CS+13 RS)   CasA,CygA

---

$f = 56 \text{ MHz}$

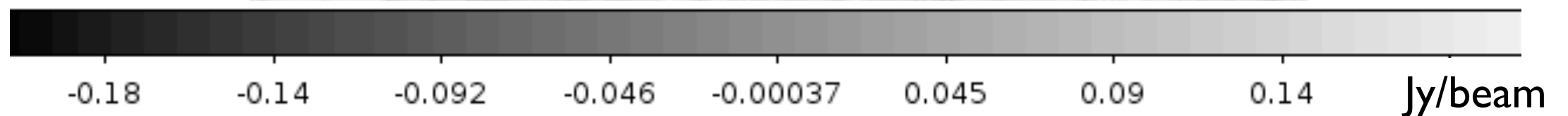
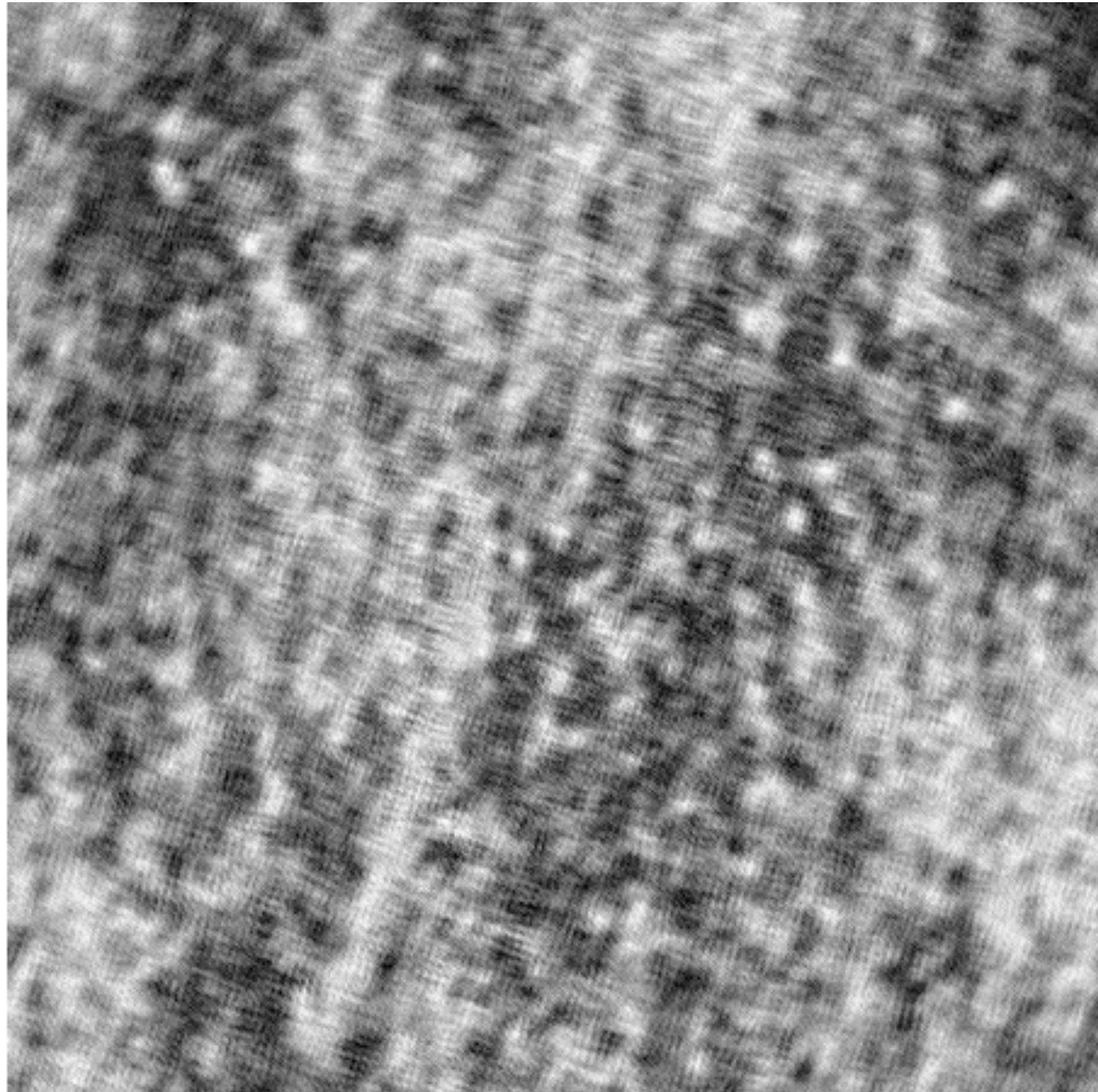
$df = 1 \text{ SB (195 kHz)}$

pixel = 5 arcsec

image = 4096x4096 pixels  
=  $6^\circ \times 6^\circ$

$(u,v) \leq 5000 \text{ wavelengths}$

CSclean (CASA)



# In progress

- BBS self-cal, improving the sky model with 13 sources identified in so far in the  $6^\circ \times 6^\circ$  field ( $>20$  present at 0.5 Jy level)

Name,	Type,	Ra,	Dec,	I (Jy),	ReferenceFrequency,	Spectral Index
B30133412 ,	POINT,	01:36:36.0,	+41.29.59,	1.04,	73.8e6,	[-0.296]
B30134411 ,	POINT,	01:37:43.0,	+41.21.49,	0.16,	408.e6,	[-0.878]
B30133408 ,	POINT,	01:36:10.4,	+41.09.16,	0.39,	152e6,	[-0.424]
<b>4C+3904,</b>	POINT,	01:39:30.4 ,	+39.57.03,	<b>18.5,</b>	<b>73.8e6,</b>	<b>[-1.125]</b>
B30135411 ,	POINT,	01:38:37.7,	+41.25.56,	1.14,	73.8e6,	[-0.675]
B30134407,	POINT,	01:37:29.1,	+40.57.12,	0.84,	73.8e6,	[-0.4]
B30136414,	POINT,	01:39:58.6,	+41.44.05,	0.72,	73.8e6,	[-0.62]
B30137413,	POINT,	01:40:22.5,	+41.39.07,	0.83,	73.8e6,	[-0.34]
B2013740,	POINT,	01:40:33.7,	+40.24.14 ,	2.54,	73.8e6,	[-0.604]
B30126415,	POINT,	01:29:15.2,	+41.47.27,	1.80 ,	73.8e6,	[-0.836]
B30127412,	POINT,	01:30:05.1,	+41.32.36,	1.23 ,	73.8e6,	[-0.534]
B2012739,	POINT,	01:30:49.3,	+40.10.08,	2.11,	73.8e6,	[-1.057]
B2012839,	POINT,	01:31:29.5,	+39.42.58,	2.59,	73.8e6,	[-0.375]

- Wide-Field image with AWWimager (mfclark), Peeling
- Rebin several SB

# Next

- Search for transients : « naïve approach »
  - Images ( $t$ )
  - Visibilities ( $t$ )  
[unresolved point source burst =  
small increase on all baselines]
- Search for transients : less naïve approach (under development)
  - FT (image pixels)
  - Compressed Sensing  $\Rightarrow (2D + t)$  sparse recovery
- Circular polarization

# Organization

- Data server in Nançay (180 Tb) + distribution  
(*databf.obs-nancay.fr*)
- Local processing :
  - Meudon/tethys server
  - Meudon/PSL mesocenter
  - Ice-like nodes in Nançay
- Ongoing data processing : J. Girard, S. Hess, C. Tasse, P. Zarka +  
E. Enriquez, W. Majid, G. Hallinan, I. Vasylieva
- Thanks to W. Frieswijk

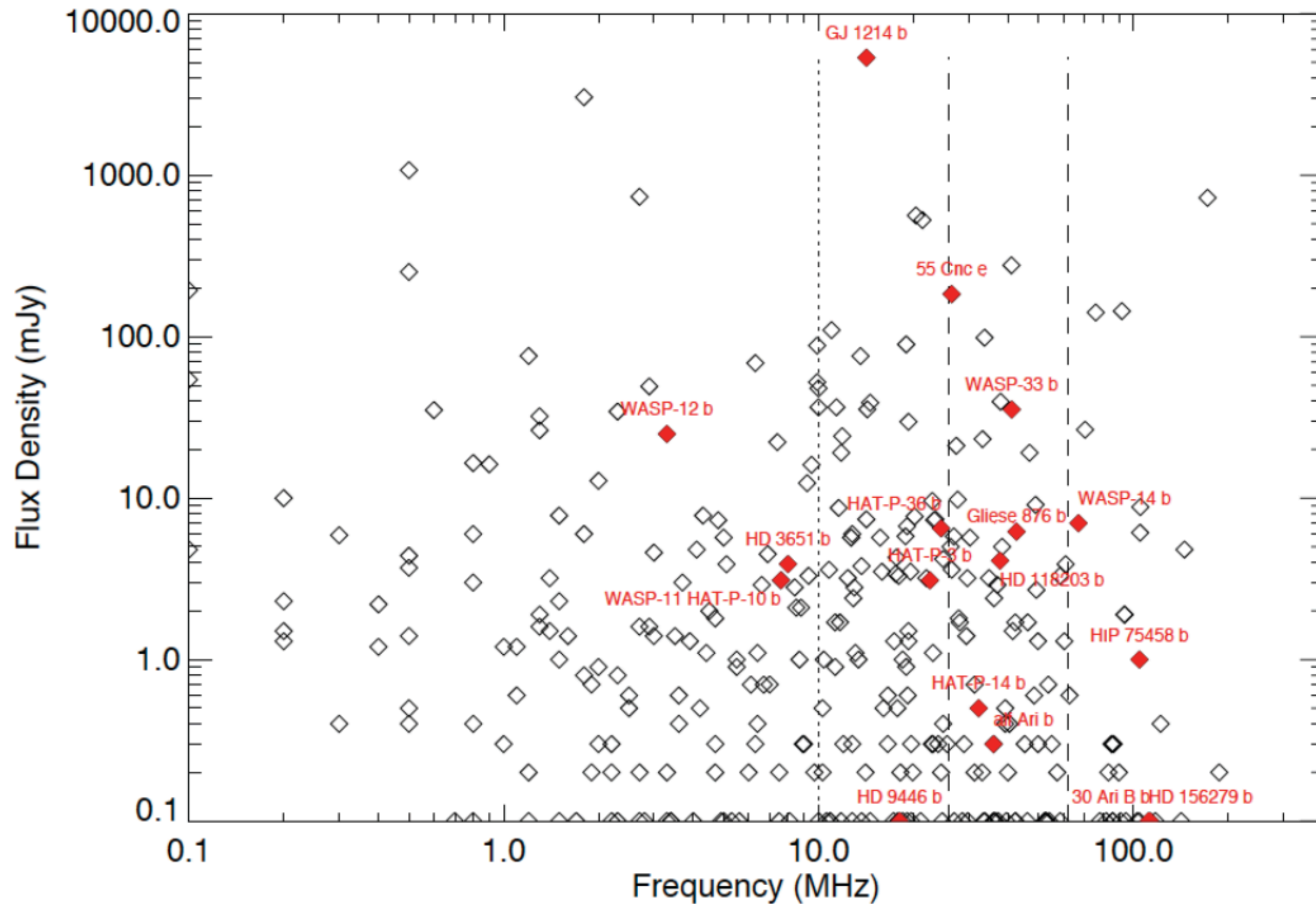


# Lessons learned

- NL IM (+BF ?), 8-bit, 48 x 2 MHz
- minimize distance to cal, maximize to A-team, J, S
- wide field imaging + peeling to maximize dynamic range
- large number of targets crucial, high enough duty-cycle

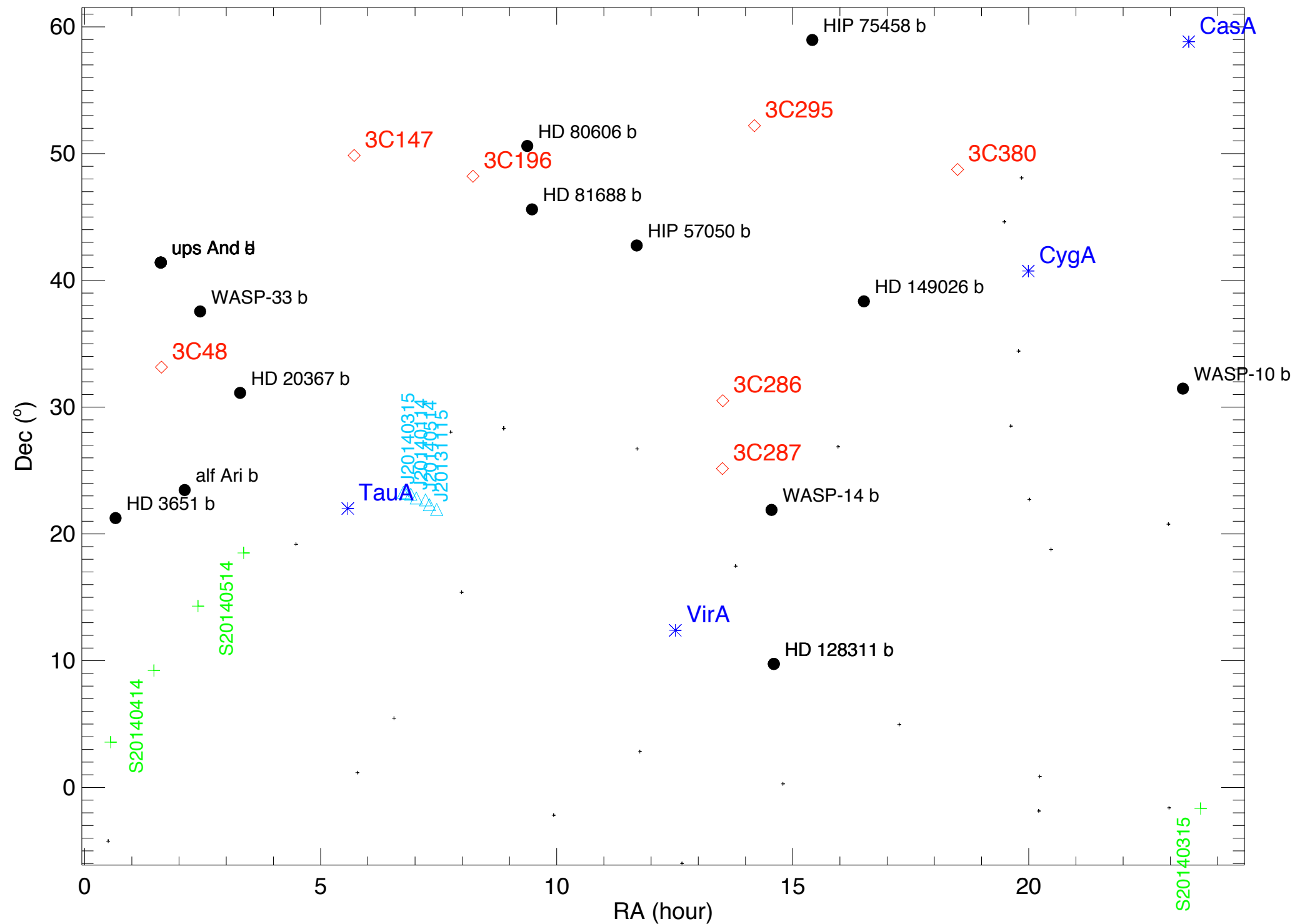
# Cycle I : "searching the keys under the streetlight"

17 optimally located «good» targets ...



# Cycle I : "searching the keys under the streetlight"

## 17 optimally located «good» targets ...



17 x 4 = 68 hr requested, 17 hr obtained ...